

Castle Mountains Restoration Project

Invasive Plant Report

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for:

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Introduction

To effectively describe the environmental consequences of project activities on invasive plant species (including noxious weeds listed by the State of Montana, and nonnative invasive plants), this environmental analysis will focus on specific proposed project actions within the Castle Mountains Restoration project area; hereinafter referred to as the effects analysis area. The analysis will include a risk assessment for each alternative which discloses the likelihood of project actions resulting in invasive plant spread, and the potential consequences of invasive plant spread and establishment within the analysis area. A specific analysis emphasis will be placed on those project actions which may result in ground disturbance highly susceptible to weed invasion (timber harvest units, for example), and treatment units where prescribed burning is being proposed.

The terms “weeds”, “noxious weeds”, “invasive species”, and “invasive plants” are used synonymously throughout this analysis. Invasive plant species are those plants that have been introduced into an environment in which they did not evolve and thus usually have no natural enemies to limit their reproduction and spread; and have the potential to produce change in terms of composition, structure, or ecosystem function. Noxious weeds, on the other hand, are those plant species designated as noxious by the Secretary of Agriculture or by the responsible State official (see *Appendix A, Montana Noxious Weed List*). Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being not native or new to or not common to the United States or parts thereof. Additionally, the term “infestation” is also used throughout this document to mean any presence of noxious weeds or invasive plants, regardless of size or extent, as this is the commonly used term within the field of practice. Not all infestations are of the same severity (i.e., density and area coverage); however, this is explained in more detail in the existing condition and environmental consequences sections of this analysis.

Resource Indicators and Measures

The following resource indicators and measures will be used to help identify and assess effects of the project on invasive plants, and to help with risk assessment rating determinations.

Table 1: Resource indicators and measures for assessing effects

Resource Element	Resource Indicator	Measure	Used to address: Purpose and Need, or key issue?	Reference
Vegetation	Invasive plant presence	Acres of invasive plants within proposed treatment units	Yes	BMP's from FSM 2000, Zero Code 2080 – Noxious Weed Management; and policy from FSM 2900 – Invasive Species Management
Vegetation	Vegetation treatment	Number of treatment units with invasive plant infestations	Yes	BMP's from FSM 2000, Zero Code 2080 – Noxious Weed Management; and policy from FSM 2900 – Invasive Species Management
Soils	Ground disturbance	Acres of predicted ground disturbance within treatment units that contain invasive plants	Yes	BMP's from FSM 2000, Zero Code 2080 – Noxious Weed Management; and policy from FSM 2900 – Invasive Species Management

Methodology

In general, it is widely accepted that (1) disturbed ground can be highly susceptible to weed invasion, (2) invasive plant infestations can alter the composition and function of native rangelands and other plant communities, and (3) burning and other management actions can potentially increase the density and spread of certain invasive species. Based on this, discussions of direct, indirect, and cumulative effects will focus on the “risk” of invasive plants spreading and/or becoming established in proposed treatment units within the effects analysis area. In the context of this effects analysis, risk is defined as the likelihood, or potential, that invasive plants would spread and/or become established due to project activities, and result in adverse effects to native plant communities.

The following assessment factors and risk rating will be used to complete an invasive plant risk assessment for each action alternative:

Factor 1 - Likelihood of undesirable plant species, including noxious weed species, spreading into the project area.

None	Undesirable plants, including noxious weed species not located within or immediately adjacent to the project area. Project activity is not likely to result in the establishment of undesirable weed species in the project area.
Low	Undesirable plant species present in areas adjacent to but not within the project area. Project activities can be implemented and prevent the spread of undesirable plants into the project area.
Moderate	Undesirable plant species located immediately adjacent to or within the project area. Project activities are likely to result in some areas becoming infested with undesirable plant species even when preventative management actions are followed. Control measures are essential to prevent the spread of undesirable plants or noxious weeds within the project area.
High	Heavy infestations of undesirable plants are located within or immediately adjacent to the project area. Project activities, even with preventative management actions, are likely to result in the establishment and spread of undesirable plants on disturbed site throughout much of the project area.

Factor 2 – Consequences of undesirable plant establishment in project area.

None to Low	No cumulative effects expected.
Moderate	Possible adverse effects on site and possible expansion of infestation within project area. Cumulative effects on native plant communities are likely, but limited.
High	Obvious adverse effects within the project area and probable expansion of undesirable plants, including noxious weed infestations to area outside the project area. Adverse cumulative effects on native plant community are probable.

Risk Rating

None	Project can proceed as planned.
Low	Project can proceed as planned. Initiate control treatments on undesirable plant populations that get established in the area.

Moderate	Develop preventative management measures for the proposed project to reduce the risk of introduction of spread of undesirable plants in the area. Preventative management measures should include modifying the project to include seeding the area to occupy disturbed sites with desirable species. Monitor area for at least 3 consecutive years and provide for control of newly established populations of undesirable plants and follow-up treatment for previously treated infestations.
High	Project must be modified to reduce risk level through preventative management measures, including seeding with desirable species to occupy disturbed sites and controlling existing infestations of undesirable plants prior to project activity. Projects must provide at least 5 consecutive years of monitoring. Projects must also provide for control of newly established populations of undesirable plants and follow-up treatment for previously treated infestations.

Information Sources

Sources used to support the analysis in this report include District invasive plant inventories and treatment data, published and unpublished invasive plant literature, Castle Mountains Restoration project soil resource report, and personal observations by the author and other Forest personnel.

Incomplete and Unavailable Information

Invasive plants are common and widely scattered along many travel routes within the analysis area, but existing inventories do not likely reflect the actual extent, or distribution, of noxious weeds or other undesirable plant species (e.g., cheatgrass) along and outside of these travel routes. It is assumed that the establishment of new, undocumented weed infestations has likely occurred, and are not reflected in the existing condition description for invasive plant presence.

Affected Environment

Existing Condition

Resource Indicator – *Invasive Plant Presence*

The Musselshell and White Sulphur Springs Ranger Districts has inventoried and mapped invasive plants (primarily noxious weeds) within the analysis area since the late 1970's or early 1980's. These inventories have typically been updated on an annual basis, and the last inventory update for the Castle Mountains Restoration analysis area was completed in 2016. Inventories generally consisted of survey and mapping of noxious weeds along National Forest System (NFS) system roads and trails by District personnel. Other survey and mapping efforts have been completed on areas away from roads and trails where weeds were known to be present. Data collected during these inventories typically included the species, size and density of each infestation, and more recently a Global Positioning System (GPS) location. This inventory data is currently stored in the Forest Service's Natural Resource Manager (NRM) Threatened, Endangered, Sensitive Plants-Invasive Species database.

Based on these inventories and personal observations, widely scattered and widespread infestations of noxious weeds and other invasive plants exist within the analysis area. According to these inventories there are currently about 598 gross acres of infested land. Net, or actual, infested acreage is estimated to be about 150 acres, which is based on an average infestation level, or density, of 25 percent for these acres. Compared to current infested acreage, in 1994 there were approximately 11 net acres of noxious weeds inventoried within the Castle Mountains Restoration analysis area (USDA 1994). These current infestations consist mostly of low-density linear weed populations along NFS roads, and occur within

about 50 feet of either side of the road prism (see Invasive Plant Inventory map in the project record). Other weed populations within the analysis area consist of area infestations where past ground disturbance had resulted in soils being highly vulnerable to weed establishment. An example of an area infestation includes the Lucky Dollar Mine site where past mining activities resulted in substantial areas of exposed mineral soil, and subsequent establishment of noxious weeds. Predominant and common weed species inventoried within the analysis area include spotted knapweed (*Centaurea stoebe*), houndstongue (*Cynoglossum officinale*), Canada thistle (*Cirsium arvense*), and musk thistle (*Carduus nutans*). Less common species reported included diffuse knapweed (*Centaurea diffusa*) and yellow toadflax (*Linaria vulgaris*). Other invasive plant species known to be present but not inventoried include cheatgrass (*Bromus tectorum*), bull thistle (*Cirsium vulgare*), and Absinth wormwood (*Artemisia absinthium*) which has been observed to be rapidly spreading along many travel routes in the Castle Mountains and Little Belt Mountains (personal observation by Kevin Greenwood).

The Judith-Musselshell and Belt Creek-White Sulphur Springs Ranger Districts have active noxious weed control programs, and for the period of 2012 through 2016 weed treatment has averaged about 102 managed, or gross, acres per year within the analysis area. Treatment, or control, of some invasive plants such as cheatgrass has not occurred because they are currently not listed as noxious weeds within the state of Montana, and control options are limited. However, invasive winter annual weed species are currently found at low levels or concentrated in specific areas, with inventories being improved on an annual basis.

The number of acres treated each year has varied considerably, and is dependent on District treatment priorities, funding levels, and number of personnel to conduct weed control work. Based on past inventories, data suggests that analysis area weed infestations have not been eradicated, or reduced, but have expanded in size and density since 1994. Weed control efforts at the present time have contained existing known infestations of noxious weed species. The current District noxious weed control programs are operating under the 1994 Lewis and Clark Noxious Weed Control Final Supplemental Environmental Impact Statement (FEIS) and Record of Decision (USDA 1994).

Resource Indicator – *Vegetation Treatment*

Certain management actions can increase the likelihood of invasive plants becoming established, and/or increase the size and density of existing infestations. This is especially true for those activities that cause or result in ground disturbance, or compromise the integrity and resiliency of native plant communities by causing them to become more susceptible to invasion by weeds. Within the Castle Mountains Restoration analysis area these activities currently consist of past and ongoing actions such as timber harvest, mining, prescribed burning, and livestock grazing. Another activity that can result in the spread of invasive plants is motor vehicle travel on NFS roads and trails, and off-route motor vehicle travel whether it's permitted or not. Motor vehicles and other motorized equipment can serve as transport vectors for weed seeds from off-site infestations, and can potentially transport and deposit these seeds across large areas that are weed-free or have minimal infestations. People, livestock, birds, and wild ungulates can also serve as vectors for weed seed transport, especially for invasive plants like houndstongue which have seeds that can easily attach to clothes, hair, or fur, and then be dispersed to weed-free areas. Depending on the action alternative considered, current invasive plant inventories indicate that noxious weeds are present in up to 47 of the proposed vegetation treatment units. Table 2 below illustrates the known presence of invasive plants within these units.

Table 2: Treatment units with invasive plants

Treatment Unit	Invasive Plants Present	Total Gross Acres	Remarks
1b, 4, 5, 6, 8a, 8b, 11, 15, 17, 17a, 19, 20, 22, 26, 31, 32, 35, 37, 103, 123, 128, 133, 134, 135, 137, 138, 140, 141, 145, 146, 148, 157, 166, 170, 173, 174, 175, 181a, 181b, 195a, 200, 203, 318, 324b, 324g, 374, 411	Spotted knapweed, diffuse knapweed, Canada thistle, musk thistle, yellow toadflax, houndstongue, and cheatgrass	319	Dominant and widespread species within the analysis area include Canada thistle, musk thistle and houndstongue. Other inventoried species are found in localized areas. For example spotted knapweed and cheatgrass are found primarily within treatment units located in the Pasture Gulch and Cooper Creek drainages, and yellow toadflax is found primarily along Forest road #581 in the Castle Town area.

Resource Indicator – *Ground Disturbance*

Vegetation management activities such as timber harvest and prescribed burning can result in ground (or soil) disturbance that is susceptible to invasion by noxious weeds or other invasive plants. Common types of ground disturbance associated with vegetation management include removal of ground cover, soil displacement, and burnt soils. Removal of ground cover results in the exposure of organic or bare mineral soil underneath which is prone to weed establishment. The use of mechanical equipment during vegetation treatments can result in soil displacement (i.e., soil being moved from one place to another) which exposes mineral soil to weed invasion. Prescribed fire can result in physical and biological changes to soil that make them more susceptible to weed invasion, or can create favorable conditions for weed expansion if invasive plants were already present during the treatment. Depending on the action alternative considered, the soil resource report for this project has determined that there are between 11 and 121 acres of existing ground disturbance within proposed treatment units.

Management Direction

Desired Condition

According to the 1986 Lewis and Clark Forest Plan (USDA 1986), a Forest-wide objective for invasive plants is that noxious weed control will be emphasized on the Forest. To achieve this objective, the Forest Plan also identified the following applicable management standards:

- Emphasize preventing noxious weeds by reseeding, with desirable plant species, mineral soil exposed by Forest activities.
- Evaluate alternatives to determine effective environmentally acceptable practices to control noxious weeds and other pests.
- Identify areas where noxious weed and/or pest control is needed. Special attention should be paid to: streams, bogs, and associated riparian habitat; upland game bird nesting habitat; and any other sensitive non-target animal or habitat which may be adversely affected by spraying.
- Cooperate closely with other Federal and State agencies, private individuals, contractors, and permittees to control noxious weed and pest infestations.

In addition, invasive species management policy found in Forest Service Manual (FSM) 2900 directs, in summary, that the Forest Service use an integrated pest management approach to prevent, control, and eliminate invasive species, and ensure that all Forest Service management activities are designed to minimize or eliminate the possibility or risk of establishment or spread of invasive species on NFS lands.

The policy also directs that the Forest Service conduct an invasive species risk assessment for each project and, where necessary, provide for alternatives or mitigation measures to reduce or eliminate any risk prior to project approval.

Environmental Consequences

Alternative 1 – No Action

Under this alternative, no new vegetation management or burning treatments would be implemented; therefore, there would be no additional risk of invasive species establishment and spread over what is currently occurring within the analysis area. Previously approved and ongoing activities such as livestock grazing, motorized vehicle travel on NFS roads and trails, mining, and noxious weed control would continue. Although implementation of this alternative would not result in new ground disturbance, ongoing management activities would continue to provide potential vectors for weed spread and establishment. Even in the absence of these ongoing activities there would be potential for weeds to invade, or spread, from unplanned actions such as wildfires or other natural disturbances. According to Zouhar (2001 and 2003) invasive plants such as spotted knapweed and cheatgrass usually establish shortly after disturbance, or invasion is accelerated by disturbance, but they can also invade relatively undisturbed perennial native plant communities where there is natural disturbance from rodents or predators digging in the soil. Ortega and Pearson (2005) also found that certain invasive plants such as spotted knapweed, houndstongue, and cheatgrass could readily invade intact native plant communities because of their aggressive nature. These invasive plants are considered to be “strong” invaders, and have been documented to invade plant communities that were considered to be healthy, diverse, and species-rich.

Within the analysis area, existing and new noxious weed infestations would continue to be treated on an annual basis by Forest Service weed control crews, and in accordance with the Lewis and Clark National Forest Noxious Weed Control Supplemental FEIS and ROD. This in turn would benefit native plant communities within the analysis area by containing and reducing the coverage and density of noxious weed infestations. Other invasive species such as cheatgrass would not receive treatment, and infestations would likely continue to expand in size and density where site conditions are favorable.

Alternative 2 – Proposed Action

The Proposed Action would use a variety of management tools and treatment types to meet restoration objectives across the landscape. This alternative would require temporary road construction to mechanically treat the most acres across the landscape to meet desired conditions. The alternative would provide commercial wood products. In regards to treatment actions being proposed under this alternative, they are listed below in Table 3.

Table 3 Summary of treatments for Alternative 2

Treatment Type	Acres
Douglas-fir thinning	945.2
Regeneration harvest	1,189.1
Meadow restoration	8,670.2
Pre-commercial thinning	308.4
Aspen restoration	322.9
Prescribed burning	7,762.3
Stand improvement thinning	1,650.3

Treatment Type	Acres
Whitebark pine restoration	856.4
Grand Total	21,704.6

Project Design Features and Mitigation Measures

The following applicable Best Management Practices are required by *Forest Service Manual (FSM) 2081.2—Prevention and Control Measures*:

Roads – Required Objectives and Associated Practices

1. Remove the seed source that could be picked up by passing vehicles and limit seed transport in new and reconstruction areas.
 - (a) Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. This does not apply to service vehicles that would stay on the roadway, traveling frequently in and out of the project area.
 - (b) Landings, skid trails, and other areas of disturbance resulting from logging activities would be monitored for weed infestations.
 - (c) Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders as determined by the Forest Weed Specialist.
2. Re-establish vegetation on bare ground due to construction and reconstruction activity to minimize weed spread.
 - (a) Revegetate (plant, seed, fertilize, or mulch) all disturbed soil, except the travel way on surfaced roads, in a manner that optimizes plant establishment for that specific site, unless ongoing disturbance at the site would prevent weed establishment. Use native material where appropriate and available. Use a certified weed-free seed mix that includes fast, early season species to provide quick, dense revegetation.
 - (b) Monitor and evaluate success of revegetation in relation to project plan. Repeat as indicated by local prescriptions.
3. Minimize the movement of existing and new weed species caused by moving infested gravel and fill material. A borrow pit would not be used if new invaders, defined by the Forest Weed Specialist, are found on site.
4. Minimize sources of weed seed in areas not yet revegetated. If straw is used for road stabilization and erosion control, it must be certified weed-free or weed-seed free.
5. Minimize roadside sources of weed seed that could be transported to other areas during maintenance.
 - (a) Look for priority weed species during road maintenance and report back to District Weed Specialist.
 - (b) Do not blade roads or pull ditches where new invaders are found.
 - (c) Maintain desirable roadside vegetation. If desirable vegetation is removed during blading or other ground disturbing activities, area must be revegetated according to section 2 (a) (b) above.

- (d) Remove all mud, soil, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that would stay on the roadway, traveling frequently in and out of the project area.)
- (e) Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders, as determined by the Forest Weed Specialist.
- (f) Straw used for road stabilization and erosion control would be certified weed-free or weed-seed-free.

6. Reduce weed establishment in road obliteration/reclamation projects. Revegetate according to section 2 (a) (b) above.

Timber – Required Objectives and Associated Practices

1. Remove all mud, soil, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that would stay on the roadway, traveling frequently in and out of the project area.)
2. Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders (as designated by the Forest Weed Specialist).
3. Minimize the creation of sites suitable for weed establishment. Revegetate bare soil as described in the Roads 2 (a) (b) section above.

There are no Best Management Practices specific to prescribed fire in *FSM 2080*. The above Best Management Practices that apply would be implemented.

Seeding Prescription

All landings, skid trails or other activity areas that have over 30% ground cover removal/soil surface disturbance due to the activity would be recontoured and seeded with a prescribed native seed mixture as soon as appropriate following the cessation of activities. Where slopes are over 15 – 20%, surfaces would be left rough to provide microtopography for seed and water catchment. Woody debris would be spread on the surface at a rate of 1 to 5 tons per acre in these areas to provide site stability as well as additional microsites.

Herbicide Application

Herbicide application before ground disturbance (road construction, logging activities on unfrozen ground, and prescribed fire) is recommended if biological agents are not going to be established. Follow up treatment of herbicide and monitoring is recommended in the ground-disturbed areas once implementation is completed for at least two seasons. The Forest would incorporate management of the disturbed areas as part of the base noxious weed program. All weed species would be treated with herbicides in these areas to try to limit the expansion as much as possible.

The portions of the haul route that require reconditioning prior to haul should be treated with herbicides prior to the reconditioning early in the growing season to prevent seed set, and again in the fall following reconditioning to limit the effect of the ground disturbance.

Cheatgrass and other winter annuals threaten to expand in acreage under all alternatives, including Alternative 2 in both vegetation treatment units as well as untreated areas. Areas with high densities of annual invasive plant species should be identified prior to project implementation occurring. Areas of concern, which could include large acreages of invasive annual plant species or infestations with a high likelihood of rapid spread following disturbance could either be avoided during development of the

prescribed burn or timber harvest activity, or have a post-implementation herbicide treatment planned to limit spread. Unless a post-fire herbicide treatment plan is in place, broadcast burning in areas where annual grasses are inventoried would be avoided.

Getz and Baker (2008) found that invasion of cheatgrass favored burn edges because of higher seed-bank survival and along roads because of moisture, disturbance, and dispersal. These areas could also be targeted for post-treatment herbicide application. Some studies have shown favorable results following a combination of prescribed burning and post-emergent herbicide treatments that reduced winter annual densities and allowed native vegetation to re-establish (Calo et al. 2012; Baker et al. 2009).

Ongoing weed spraying and grazing management would employ avoidance or mitigation techniques to limit potential impacts to regenerating stands.

Direct and Indirect Effects

Table 4 Resource indicators and measures for Alternative 2

Resource Element	Resource Indicator	Measure	Alternative 2
Vegetation	Invasive plant presence	Acres of invasive plants within proposed treatment units	Gross acres – 317 Net acres - 79
Vegetation	Vegetation treatment	Number of treatment units with invasive plant infestations	43
Soils	Ground disturbance	Acres of predicted ground disturbance within treatment units that contain invasive plants	375

Resource Indicators and Measures

Under this alternative there would be 317 gross acres of noxious weed infestations located within 43 of the proposed vegetation management treatment units. Of these 43 units, 16 are being proposed for timber management type actions using mechanical equipment, and the remainder of the units are being proposed for restoration and/or fuels reduction using a variety of treatment methods including mechanical, prescribed fire, and/or hand treatments.

Implementation of this alternative would not result in direct effects to invasive plant presence or the number of vegetation management treatment units currently containing invasive plant infestations. In regards to ground disturbance, vegetation management actions could result in direct effects to the soil resource. Specifically, the use of mechanical equipment could result in soil displacement or ground cover removal which would make the soils more susceptible to invasion by weeds if they are currently present within the unit, or adjacent to them. If proposed soils project design features and mitigation measures are implemented, the amount of ground disturbance from project actions would be reduced substantially (see Soil Resource Report). According to the soils resource report total unmitigated ground disturbance acres would be approximately 2,176 acres, whereas mitigated acres would total about 1,235 acres. Of these total mitigated acres, about 375 acres of ground disturbance would occur within proposed treatment units that contain invasive plants.

Potential indirect effects of proposed project actions would consist primarily of the subsequent invasion, or expansion of existing weed infestations following ground disturbing activities. However, this potential threat would be reduced if suggested invasive plant and soils design features and mitigation are implemented, and existing and new noxious weed infestations would continue to be treated on an annual basis by Forest Service weed control crews.

Cumulative Effects

Spatial and Temporal Context for Effects Analysis

The spatial boundaries for analyzing cumulative effects to invasive plants will be confined to the Castle Mountains Restoration project area boundary. This boundary was selected because the effects of proposed management actions are not anticipated to result in invasive plant establishment and spread outside of the project area, but would be mostly confined to proposed vegetation treatment unit boundaries.

The temporal boundaries for the analysis include both short-term and long-term effects of invasive plants that result from proposed management actions. Short-term effects from invasive plants would include the establishment of new infestations that are controlled, or eradicated, when the infestations are small, and the duration of ecological impacts are minimized. The timeframe for eradicating a small population of weeds (i.e., 0.01 acre or less) will generally be about three to five years with annual, multiple treatments.

The potential long-term effect of invasive plants is more difficult to quantify on a timescale. If left untreated, or control actions are unsuccessful, new invasive plant populations can expand at a rapid rate under favorable site conditions. Once an infestation has grown beyond about 0.1 acres, successful control or eradication becomes more problematic and time-consuming. Consistent and thorough treatment over a period of about 10 years may be needed to eradicate a smaller population, but larger infestations would likely continue to expand in size. This could result in long-lasting ecological effects to native plant communities. Some invasive plants such as cheatgrass can become a permanent and widespread feature on the landscape.

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

Table 5: Resource Indicators and Measures for Cumulative Effects

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Alternative 2 (Units)	Past, Present, and Future Actions (Units)	Cumulative Impacts (Units)
Vegetation	Invasive plant presence	Acres of invasive plants within proposed treatment units	317 gross acres	281 gross acres	598 gross acres
Vegetation	Vegetation treatment	Number of treatment units with invasive plant infestations	43	Unknown	43
Soils	Ground disturbance	Acres of predicted ground disturbance within treatment units that contain invasive plants	375	69	444

Resource Indicators and Measures

Implementation of Alternative 2 could result in the introduction, spread, and/or expansion of invasive plants. The effects of this alternative when added to past, present, and reasonably foreseeable future actions such as livestock grazing, timber harvest, mining, and prescribed burning would potentially increase invasive plant presence within the analysis area, including the introduction of noxious weeds into new areas where ground disturbance has, or will, occur. As an example, noxious weeds could invade proposed treatment units where weeds are currently not present because weed seeds were introduced

from equipment, or an existing infestation was present adjacent to the unit. Although there is a moderate likelihood that noxious weeds could expand within the analysis area, implementation of proposed invasive plant project design features and mitigation, and ongoing noxious weed control work within the analysis area, would help reduce the spread and establishment of weeds.

Invasive Plant Risk Assessment for Alternative 2

Using risk factors identified under the methodology section of this document, it has been determined that implementation of Alternative 2 project actions with proposed design features and mitigation would result in a moderate risk of invasive plants spreading within, or into, the project area. This means that project activities are likely to result in expansion of weed infestations in some treatment units even when preventative management actions are implemented, and result in likely, but limited, cumulative effects to native plant communities.

Alternative 3

This action alternative meets restoration objectives across the landscape using a variety of management tools and treatment types that will optimize a variety of wildlife habitat across the landscape. The design of this alternative puts emphasis on maintaining effective big game travel corridors, suitable lynx habitat areas, maintains open meadows and natural parks, promotes whitebark pine and aspen regeneration. Prescribed fire will be utilized to mimic natural process as a standalone treatment as well as in conjunction with other treatments. This alternative would provide a level of commercial wood products and is responsive to several scoping comments including harvest opening sizes, temporary roads, water quality and big game security. Treatment actions being proposed under this alternative are listed below in Table 6.

Table 6: Summary of treatments for Alternative 3

Treatment Type	Acres
Douglas-fir thinning	768
Regeneration harvest	376
Meadow restoration	8,549
Pre-commercial thinning	286
Aspen restoration	339
Prescribed burning	6,634
Stand improvement thinning	1,161
Whitebark pine restoration	856
Grand Total	23,539

Project Design Features and Mitigation Measures

The following applicable Best Management Practices are required by *FMS 2081.2—Prevention and Control Measures* (FSM 2080, 5/14/01) (USDA 2001).

Same as Alternative 2.

Direct and Indirect Effects

Table 7: Resource indicators and measures for Alternative 3

Resource Element	Resource Indicator	Measurement	Alternative 3
Vegetation	Invasive plant presence	Acres of invasive plants within proposed treatment units	Gross acres – 217 Net acres - 54
Vegetation	Vegetation treatment	Number of treatment units with invasive plant infestations	41
Soils	Ground disturbance	Acres of predicted ground disturbance within treatment units that contain invasive plants.	287

Resource Indicators and Measures

Under this alternative there would be 217 gross acres of noxious weed infestations located within 41 of the proposed vegetation management treatment units. Of these 41 units, 13 are being proposed for timber management type actions using mechanical equipment, and the remainder of the units are being proposed for restoration and/or fuels reduction using a variety of treatment methods including mechanical, prescribed fire, and/or hand treatments.

Implementation of this alternative would result in direct and indirect effects very similar to those described under Alternative 2. However, the total number of treatment units with noxious weed infestations, and total predicted acres of ground disturbance within treatment units would be somewhat less. In theory this alternative would be expected to result in a reduced weed invasion risk when compared to Alternative 2. In regards to ground disturbance, total unmitigated ground disturbance acres would be approximately 1,710 acres, whereas mitigated acres would total about 1,066 acres. Of these total mitigated acres, about 287 acres of ground disturbance would occur within proposed treatment units that contain invasive plants.

Cumulative Effects

Spatial and Temporal Context for Effects Analysis

The spatial boundaries for cumulative effects to invasive plants will be confined to the Castle Mountains Restoration project area boundary. This boundary was selected because the effects of proposed management actions are not anticipated to result in invasive plant establishment and spread outside of the project area, but would be mostly confined to proposed vegetation treatment unit boundaries.

The temporal boundaries for the analysis include both short-term and long-term effects of invasive plants that result from proposed management actions. Short-term effects from invasive plants would include the establishment of new infestations that are controlled, or eradicated, when the infestations are small, and the duration of ecological impacts are minimized. The timeframe for eradicating a small population of weeds (i.e., 0.01 acre or less) will generally be about three to five years with annual, multiple treatments.

The potential long-term effect of invasive plants is more difficult to quantify on a timescale. If left untreated, or control actions are unsuccessful, new invasive plant populations can expand at a rapid rate under favorable site conditions. Once an infestation has grown beyond about 0.1 acres, successful control or eradication becomes more problematic and time-consuming. Consistent and thorough treatment over a period of about 10 years may be needed to eradicate a smaller population, but larger infestations would likely continue to expand in size. This could result in long-lasting ecological effects to native plant

communities. Some invasive plants such as cheatgrass can become a permanent and widespread feature on the landscape.

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

Table 8: Resource indicators and measures for cumulative effects

Resource Element	Resource Indicator	Measure	Alternative 3 (Units)	Past, Present, and Future Actions (Units)	Cumulative Impacts (Units)
Vegetation	Invasive plant presence	Acres of invasive plants within proposed treatment units	217 gross acres	381 gross acres	598 gross acres
Vegetation	Vegetation treatment	Number of treatment units with invasive plant infestations	41	Unknown	41
Soils	Ground disturbance	Acres of predicted ground disturbance within treatment units that contain invasive plants	287	49	336

Resource Indicators and Measures

Implementation of this alternative would result in cumulative effects very similar to those described under Alternative 2. However, the effects of this alternative when added to past, present, and reasonably foreseeable future actions such as livestock grazing, timber harvest, mining, and prescribed burning would result in less potential for increasing the expansion of invasive plant populations within the analysis area due to fewer proposed treatment units containing noxious weeds, and fewer acres of cumulative ground disturbance. Similar to Alternative 2, there would still be a moderate likelihood that noxious weeds could expand within the analysis area, but implementation of proposed invasive plant project design features and mitigation, and ongoing noxious weed control work within the analysis area, would help reduce the spread and establishment of weeds.

Invasive Plant Risk Assessment for Alternative 3

Using risk factors identified under the methodology section of this document, it has been determined that implementation of Alternative 3 project actions with proposed design features and mitigation would result in a moderate risk of invasive plants spreading within, or into, the project area. This means that project activities are likely to result in expansion of weed infestations in some treatment units even when preventative management actions are implemented, and result in likely, but limited, cumulative effects to native plant communities.

Alternative 4

This action alternative was requested in scoping comments to consider only treatments that would not require a forest plan exception (amendment) to a standard. This alternative would only treat a limited number of acres primarily on the west side of the analysis area and will not meet the desired restoration

objective across the landscape. This alternative has been developed and considered but will not be analyzed in detail as it would not meet the project purpose and need for landscape level restoration. Treatment actions being proposed under this alternative are listed below in Table 9.

Table 9: Summary of treatments for Alternative 4

Treatment Type	Acres
Douglas-fir thinning	27.9
Regeneration harvest	178.4
Meadow restoration	1,569.5
Aspen restoration	64.3
Prescribed burning	409.0
Stand improvement thinning	128.3
Whitebark pine restoration	856.4
Grand Total	3,233.7

Direct, Indirect and Cumulative Effects Summary

There would be no direct effects to invasive plants under this alternative. Potential indirect effects such as invasion by noxious weeds following management actions would be negligible to very minimal due to the absence of invasive plants within treatment units, and greatly reduced acres of predicted ground disturbance when compared to other action alternatives.

In regards to cumulative effects, the effects of this alternative when added to past, ongoing, and future actions within the analysis area would result in minimal expansion of invasive plant populations.

Alternative 5 – Preferred Alternative

The Preferred Alternative would continue to use a variety of management tools and treatment types to meet restoration objectives across the landscape, but addresses fuels treatments concerns along private land boundaries. The alternative adjusted unit boundaries of some prescribed fire and commercial units from Alternative 2 and added two new prescribed fire units in the Hall Creek area. This alternative would require temporary road construction, although less than Alternative 2. The alternative would also provide commercial wood products. Treatment actions being proposed under this alternative, they are listed in the table below.

Table 10 Summary of treatments for Alternative 5

Treatment Type	Acres
Douglas-fir thinning	1,114
Regeneration harvest	1,155
Meadow restoration	8,778
Pre-commercial thinning	419
Aspen restoration	286
Prescribed burning	8,063
Stand improvement thinning	1,799
Whitebark pine restoration	856.4
Grand Total	22,551

Project Design Features and Mitigation Measures

The following applicable Best Management Practices under Alternative 2 will be required and followed under Alternative 5.

Herbicide Application

Herbicide treatments will follow the same protocol as in Alternative 2.

Direct and Indirect Effects

Effects of Alternative 5 will be similar to effects disclosed in Alternative 2.

Table 11: Resource indicators and measures for Alternative 5

Resource Element	Resource Indicator	Measure	Alternative 5
Vegetation	Invasive plant presence	Acres of invasive plants within proposed treatment units	Gross acres – 319 Net acres – 81
Vegetation	Vegetation treatment	Number of treatment units with invasive plant infestations	47 Some units subdivided from Alt 2 and smaller in acreage. Unit 411 contains the two additional acres of invasive.
Soils	Ground disturbance	Acres of predicted ground disturbance within treatment units that contain invasive plants	< 375

Resource Indicators and Measures

Under this alternative there would be 319 gross acres of noxious weed infestations located within 47 of the proposed vegetation management treatment units. With 846 additional acres within units in Alternative 5 as compared to Alternative 2, only two more inventoried acres of invasive species are present, which are found in unit 411. Additional units with invasive species are due to subdividing original treatment units in Alternative 2. Direct and indirect effects of Alternative 5 would be similar to Alternative 2 for invasive species. Threats of invasive species would be mitigated by implementation of invasive plant and soils design features and mitigations. Existing and new noxious weed infestations would continue to be treated on an annual basis by Forest Service weed control crews.

Cumulative Effects

Spatial and Temporal Context for Effects Analysis

The spatial and temporal boundaries are the same as Alternative 2.

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

Table 12: Resource Indicators and Measures for Cumulative Effects of Alternative 5

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Alternative 5 (Units)	Past, Present, and Future Actions (Units)	Cumulative Impacts (Units)
Vegetation	Invasive plant presence	Acres of invasive plants within proposed treatment units	319 gross acres	281 gross acres	600 gross acres

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Alternative 5 (Units)	Past, Present, and Future Actions (Units)	Cumulative Impacts (Units)
Vegetation	Vegetation treatment	Number of treatment units with invasive plant infestations	47	Unknown	47
Soils	Ground disturbance	Acres of predicted ground disturbance within treatment units that contain invasive plants	375	69	444

Resource Indicators and Measures

Implementation of Alternative 5 could result in the introduction, spread, and/or expansion of invasive plants. The effects of this alternative when added to past, present, and reasonably foreseeable future actions such as livestock grazing, timber harvest, mining, and prescribed burning would be similar to Alternative 2 within the analysis area.

Invasive Plant Risk Assessment for Alternative 5

Using risk factors identified under the methodology section of this document, it has been determined that implementation of Alternative 5 project actions with proposed design features and mitigation would result in a moderate risk of invasive plants spreading within, or into, the project area. This means that project activities are likely to result in expansion of weed infestations in some treatment units even when preventative management actions are implemented, and result in likely, but limited, cumulative effects to native plant communities.

Regulatory Framework

Land and Resource Management Plan

The Lewis and Clark National Forest Land and Resource Management Plan (LRMP), or Forest Plan, provides standards and guidelines for the prevention and control of invasive plants, primarily noxious weeds. The following management standards would apply to the Castle Mountains Restoration project:

- Emphasize preventing noxious weeds by reseeding, with desirable plant species, mineral soil exposed by Forest activities.
- Evaluate alternatives to determine effective environmentally acceptable practices to control noxious weeds and other pests.
- Identify areas where noxious weed and/or pest control is needed. Special attention should be paid to: streams, bogs, and associated riparian habitat; upland game bird nesting habitat; and any other sensitive non-target animal or habitat which may be adversely affected by spraying.
- Cooperate closely with other Federal and State agencies, private individuals, contractors, and permittees to control noxious weed and pest infestations.

Management Area

The following Forest Plan management area (MA) direction would apply to invasive plants on all management areas, except MA-J, within the Castle Mountains Restoration project analysis area:

- Cooperate closely with other Federal and State agencies, individuals, contractors, and permittees to control noxious weed and pest infestations.

Federal Law

Federal Land Policy and Management Act (1976)

(Public Law 94-579) provides authority to control weeds on rangelands as part of a rangeland improvement program.

Federal Noxious Weed Act (1974)

States that each federal agency shall establish and adequately fund an undesirable plant management program; complete and implement cooperative agreements with state agencies regarding the management of undesirable plant species on federal lands under the agency's jurisdiction; and establish an integrated management system to control or contain undesirable plant species targeted under cooperative agreements.

National Forest Management Act (1976)

Requires that project level decisions which authorize the use of specific National Forest System lands for a particular purpose must be consistent with the broad programmatic direction established in a Land and Resource Management Plan. This act is applicable to this project because the decision to implement vegetation management actions, or other actions, would need to be consistent with invasive plant management standards and other applicable direction found in the 1986 Lewis and Clark Land and Resource Management Plan, or Forest Plan.

Executive Orders

Invasive Species, EO 13112 of February 3, 1999

Directs Federal agencies to: (1) identify actions that may affect status of an invasive species; (2)(a) prevent introduction of such species; (b) detect and control such species; (c) monitor population of such species; (d) provide for restoration of native species; (e) conduct research on invasive species and develop technologies to prevent introduction of such species; (f) promote public education of such species; and (3) not authorize, fund, or carry out actions likely to cause the introduction or spread of invasive species in the United States or elsewhere unless the benefits of the action clearly outweigh the harm and the agencies take steps to minimize the harm.

State and Local Law

The State of Montana County Noxious Weed Management Act

States that it is unlawful for any person to permit any noxious weed to propagate or go to seed on the person's land, except that any person who adheres to the noxious weed management program of the person's weed management district or who has entered into and is in compliance with a noxious weed management agreement is considered to be in compliance with this section.

Compliance with LRMP and Other Relevant Laws, Regulations, Policies and Plans

Lewis and Clark National Forest Plan (1986)

The decision to implement vegetation management activities would be in compliance with Forest Plan direction for noxious weeds and other invasive plants if proposed project design features and mitigation for invasive plants are properly implemented.

National Forest Management Act (1976)

The decision to implement vegetation management activities within the Castle Mountains Restoration project area would be in compliance with noxious weed programmatic management direction established in the Forest Plan if proposed invasive plant project design features and mitigation are properly implemented.

Short-term Uses and Long-term Productivity

Existing invasive plant populations are currently impacting the long-term productivity of about 598 acres of National Forest System land within the Castle Mountains Restoration project area. Although there is a moderate risk of project actions increasing the spread or expansion of existing noxious weed infestations, the implementation of proposed invasive plant project design features and mitigation would reduce this risk. In addition, the continued treatment (i.e., herbicide application) of noxious weeds by Forest Service weed control crews would help maintain existing land productivity, and possibly improve the productivity of affected acres over the next decade.

Unavoidable Adverse Effects

There would be no unavoidable adverse effects from invasive plants associated with implementation of any of the project alternatives. Although there is a moderate risk of project actions increasing the spread or expansion of existing noxious weed infestations, the implementation of proposed invasive plant project design features and mitigation would reduce this risk and limit adverse effects to native plant communities. In addition, the continued treatment of noxious weeds by Forest Service weed control crews would also help minimize adverse effects from invasive plants by limiting, or preventing, the spread of existing infestations.

Irreversible and Irretrievable Commitments of Resources

There would be no irreversible and irretrievable commitment of resources pertaining to invasive plants. Although some invasive plant infestations (e.g., cheatgrass) can result in long-lasting, or permanent, impacts to the productivity of land, proposed invasive plant project design features and mitigation would reduce or limit adverse effects from invasive plants on some resources such as soils and forage productivity.

Required Monitoring

There would be no required monitoring pertaining to effects of project alternative actions on invasive plants.

Summary

Degree to Which the Purpose and Need for Action is Met

Table 13: Summary comparison of how the alternatives address the Purpose and Need

Purpose and Need	Indicator/Measure	Alt. 1	Alt. 2	Alt. 3	Alt. 5
More resilient grasslands, and reduction of conifer encroachment	Acres of invasive plants within proposed treatment units	There would be no vegetation treatments; therefore, there would be no additional risk of invasive species establishment and spread over what is currently occurring within analysis area grasslands.	There would be a moderate risk of project actions increasing the spread or expansion of invasive plants into analysis area grasslands, but the risk would be reduced if invasive plant mitigation is properly implemented.	There would be a moderate risk of project actions increasing the spread or expansion of invasive plants into analysis area grasslands, but the risk would be reduced if invasive plant mitigation is properly implemented.	There would be a moderate risk of project actions increasing the spread or expansion of invasive plants into analysis area grasslands, but the risk would be reduced if invasive plant mitigation is properly implemented.

Degree to Which the Alternatives Address the Issues

Table 14: Summary comparison of how the alternatives address the key issues

Issue	Indicator/Measure	Alt. 1	Alt. 2	Alt. 3	Alt. 5
Trails in stream corridors or repeated crossings of stream channels impact water quality by increasing sedimentation	Number of trail stream crossings	73	44	56	44
Trails in low-lying wet areas impact water quality by increasing sedimentation and denuding vegetation	Trail in riparian corridor (miles)	17	9	10	9

Summary of Environmental Effects

Table 15. Summary comparison of environmental effects to invasive plants

Resource Element	Indicator/Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 5
Vegetation	Acres of invasive plants within proposed treatment units	0	317 acres	216 acres	319 acres
Vegetation	Number of treatment units with invasive plant infestations	0	43	41	47

Resource Element	Indicator/Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 5
Soils	Acres of predicted ground disturbance within treatment units that contain invasive plants	0	375 acres	287 acres	< 375 acres but > 287 acres

Other Agencies and Individuals Consulted

None

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APPENDIX A

Montana Noxious Weed List

Effective: July 2015

PRIORITY 1A These weeds are not present or have a very limited presence in Montana. Management criteria will require eradication if detected, education, and prevention:

- (a) Yellow starthistle (*Centaurea solstitialis*)
- (b) Dyer's woad (*Isatis tinctoria*)
- (c) Common Reed (*Phragmites australis* ssp. *australis*)

PRIORITY 1B These weeds have limited presence in Montana.

Management criteria will require eradication or containment and education:

- (a) Knotweed complex (*Polygonum cuspidatum*, *P. sachalinense*, *P. × bohemicum*, *Fallopia japonica*, *F. sachalinensis*, *F. × bohémica*, *Reynoutria japonica*, *R. sachalinensis*, and *R. × bohémica*)
- (b) Purple loosestrife (*Lythrum salicaria*)
- (c) Rush skeletonweed (*Chondrilla juncea*)
- (d) Scotch broom (*Cytisus scoparius*)

PRIORITY 2A These weeds are common in isolated areas of Montana. Management criteria will require eradication or containment where less abundant. Management shall be prioritized by local weed districts:

- (a) Tansy ragwort (*Senecio jacobaea*, *Jacobaea vulgaris*)
- (b) Meadow hawkweed complex (*Hieracium caespitosum*, *H. praealtum*, *H. floridundum*, and *Pilosella caespitosa*)
- (c) Orange hawkweed (*Hieracium aurantiacum*, *Pilosella aurantiaca*)
- (d) Tall buttercup (*Ranunculus acris*)
- (e) Perennial pepperweed (*Lepidium latifolium*)
- (f) Yellowflag iris (*Iris pseudacorus*)
- (g) Blueweed (*Echium vulgare*)
- (h) Eurasian watermilfoil (*Myriophyllum spicatum*)
- (i) Flowering rush (*Butomus umbellatus*)

PRIORITY 2B These weeds are abundant in Montana and widespread in many counties. Management criteria will require eradication or containment where less abundant. Management shall be prioritized by local weed districts:

- (a) Canada thistle (*Cirsium arvense*)
- (b) Field bindweed (*Convolvulus arvensis*)
- (c) Leafy spurge (*Euphorbia esula*)
- (d) Whitetop (*Cardaria draba*, *Lepidium draba*)

- (e) Russian knapweed (*Acroptilon repens*, *Rhaponticum repens*)
- (f) Spotted knapweed (*Centaurea stoebe*, *C. maculosa*)
- (g) Diffuse knapweed (*Centaurea diffusa*)
- (h) Dalmatian toadflax (*Linaria dalmatica*)
- (i) St. Johnswort (*Hypericum perforatum*)
- (j) Sulfur cinquefoil (*Potentilla recta*)
- (k) Common tansy (*Tanacetum vulgare*)
- (l) Oxeye daisy (*Leucanthemum vulgare*)
- (m) Houndstongue (*Cynoglossum officinale*)
- (n) Yellow toadflax (*Linaria vulgaris*)
- (o) Saltcedar (*Tamarix spp.*)
- (p) Curlyleaf pondweed (*Potamogeton crispus*)
- (q) Hoary alyssum (*Berteroa incana*)

Priority 3 Regulated Plants: (NOT MONTANA LISTED NOXIOUS WEEDS)

These regulated plants have the potential to have significant negative impacts. The plant may not be intentionally spread or sold other than as a contaminant in agricultural products. The state recommends research, education and prevention to minimize the spread of the regulated plant.

- (a) Cheatgrass (*Bromus tectorum*)
- (b) Hydrilla (*Hydrilla verticillata*)
- (c) Russian olive (*Elaeagnus angustifolia*)
- (d) Brazilian waterweed (*Egeria densa*)
- (e) Parrot feather watermilfoil (*Myriophyllum aquaticum* or *M. brasiliense*)